

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Beilin et al.
Serial No.: Unassigned
Filed: Herewith
For: METHODS OF PLANARIZING
STRUCTURES ON WAFERS
AND SUBSTRATES BY POLISHING
Examiner: S. Ahmed
Group Art Unit: 1746
Attorney Docket: 25916-111 (53755)

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June 12, 2001

By

Jordan Wilson

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Please enter the following Preliminary Amendment to the accompanying patent application:

In The Specification:

On page 1, line 3, before 'FIELD OF THE INVENTION', insert the following paragraph:

--- This application is a continuation application of copending applications having Serial No. 09/259,125, filed February 26, 1999. Application Serial No. 09/259,125 is a continuation application of application having Serial No. 08/717,266, filed on September 20, 1996. Benefit of all earlier filing dates is claimed.---

In The Claims:

Please cancel Claims 1-21 without prejudice, and amend Claim 22 as follows:

22. (Amended) A chemical mechanical polishing method of planarizing a structure comprising a material layer and copper (Cu), said structure being formed on a surface of a substrate, said method comprising the steps of:

- (a) forming a polish-stop layer comprising tungsten (W) which is positioned along at least one side of the structure;
- (b) polishing initially the material layer in a slurry comprising an abrasive and phosphoric acid (H_3PO_4); and
- (c) polishing subsequently and simultaneously the material layer and the copper in the slurry until contacting the polish-stop layer.

Please add the following new claims.

29. (New) A method of polishing a structure comprising a material layer and copper (Cu), said structure being formed on a surface of a substrate, said method comprising:

- (a) forming a polish-stop layer comprising tungsten (W) which is positioned along at least one side of the structure; and
- (b) polishing simultaneously the material layer and the copper in a slurry comprising a mixture of an abrasive and phosphoric acid.

30. (New) The method of Claim 29 wherein the phosphoric acid has a concentration of at least 0.001 percent by weight of the slurry.

31. (New) The method of Claim 29 wherein the phosphoric acid has a concentration of at least 0.01 percent by weight of the slurry.

32. (New) The method of Claim 29 wherein said slurry has a pH value of less than 6.0.

33. (New) The method of Claim 29 wherein said slurry has a pH value ranging from about 2.0 to about 4.0.

34. (New) The method of Claim 29 wherein said structure is at least partially embedded in a layer of material which comprises substantially no copper material.

35. (New) The method of Claim 29 wherein a portion of said polish-stop layer is formed over a portion of the structure.

36. (New) A method of decreasing the rate at which tungsten material is removed by a polishing slurry in a polishing process while not increasing the rate at which copper material is removed, said method comprising adding phosphoric acid to the polishing slurry.

37. (New) The method of Claim 36 wherein the slurry has a pH value of less than about 6.0.

38. (New) The method of Claim 36 wherein the slurry has a pH value ranging from about 2.0 to about 4.0.

39. (New) A chemical mechanical polishing method of planarizing a structure comprising:

providing a substrate supporting a material layer including at least partially embedded copper (Cu);
forming at least one polish-stop layer on the material layer; and
polishing the material layer and the copper before contracting the polish-stop layer.

40. (New) The method of Claim 39 wherein said polishing comprises polishing simultaneously the material layer and the copper.

41. (New) The method of Claim 39 wherein said polishing comprises polishing simultaneously the material layer and the copper until contacting the polish-stop layer.

42. (New) The method of Claim 39 wherein said polishing is performed with a polisher until a portion of said material layer and said copper becomes generally aligned with said polish-stop layer.

43. (New) The method of Claim 39 wherein said polishing continues until a portion of the material layer and the copper becomes generally aligned with the polish-stop layer.

44. (New) The method of Claim 39 wherein said polishing comprises polishing a portion of said material layer before polishing a portion of the copper.

45. (New) The method of Claim 39 wherein said forming of at least one polish-stop layer comprises forming said at least one polish-stop layer on an upper surface of said material layer such that a portion of the material layer and the copper extends above the polish stop layer.

46. (New) The method of Claim 39 wherein said forming of at least one polish-stop layer comprises forming a pair of polish-stop layers on an upper surface of said material layer such that a portion of the material layer and the copper extends between and above the pair of polish-stop layers.

47. (New) The method of Claim 46 wherein said copper comprises a copper post.

48. (New) The method of Claim 39 wherein said polishing comprises chemical mechanical polishing.

49. (New) The method of Claim 39 wherein said polish-stop layer comprises tungsten (W).

50. (New) The method of Claim 39 wherein said polish-stop consists essentially of tungsten (W).

51. (New) The method of Claim 39 wherein said polishing comprises polishing the material layer and the copper in a slurry comprising an abrasive and an acid.

52. (New) The method of Claim 51 wherein said acid is phosphoric acid (H_3PO_4).

53. (New) The method of Claim 39 wherein said polishing comprises polishing the material layer and the copper in a slurry consisting of an abrasive and phosphoric acid (H_3PO_4).

54. (New) The method of Claim 39 wherein said polish-stop layer consists of a material which is more resistant to polishing than the material layer and the copper.

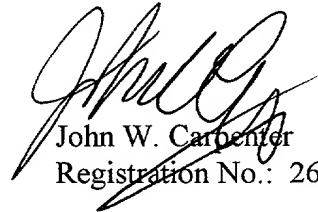
REMARKS

In this Preliminary Amendment, claims 1-21 are canceled, Claim 22 is amended, and claims 29-54 are added, so that claims 22-54 are pending. A "Version With Markings To Show Changes Made" accompanies this Preliminary Amendment.

Support for the newly added claims can be found throughout the specification, claims and drawings as originally filed. For example, support for new Claims 29 to 38 can be found in original Claims 1-21 as well as at page 15, line 1 to page 17, line 9 of the specification as originally filed.

A favorable Action on the merits is solicited.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

The following paragraph has been added on page 1, line 3:

This application is a continuation application of copending applications having Serial No. 09/259,125, filed February 26, 1999. Application Serial No. 09/259,125 is a continuation application of application having Serial No. 08/717,266, filed on September 20, 1996. Benefit of all earlier filing dates is claimed.

In the Claims:

Claims 1-21 have been cancelled without prejudice.

Claim 22 has been amended as follows:

22. (Amended) A chemical mechanical polishing method of planarizing a structure comprising a material layer and copper (Cu), said structure being formed on a surface of a substrate, said method comprising the steps of:

- (a) forming a polish-stop layer comprising tungsten (W) which is positioned along at least one side of the structure; ~~and~~
- (b) polishing ~~the structure~~ initially the material layer in a slurry comprising an abrasive and phosphoric acid (H_3PO_4); and
- (c) polishing subsequently and simultaneously the material layer and the copper in the slurry until contacting the polish-stop layer.

The following Claims 29-54 have been added as new claims.

29. (New) A method of polishing a structure comprising a material layer and copper (Cu), said structure being formed on a surface of a substrate, said method comprising:

- (a) forming a polish-stop layer comprising tungsten (W) which is positioned along at least one side of the structure; and
- (b) polishing simultaneously the material layer and the copper in a slurry comprising a mixture of an abrasive and phosphoric acid.

30. (New) The method of Claim 29 wherein the phosphoric acid has a concentration of at least 0.001 percent by weight of the slurry.

31. (New) The method of Claim 29 wherein the phosphoric acid has a concentration of at least 0.01 percent by weight of the slurry.

32. (New) The method of Claim 29 wherein said slurry has a pH value of less than 6.0.

33. (New) The method of Claim 29 wherein said slurry has a pH value ranging from about 2.0 to about 4.0.

34. (New) The method of Claim 29 wherein said structure is at least partially embedded in a layer of material which comprises substantially no copper material.

35. (New) The method of Claim 29 wherein a portion of said polish-stop layer is formed over a portion of the structure.

36. (New) A method of decreasing the rate at which tungsten material is removed by a polishing slurry in a polishing process while not increasing the rate at which copper material is removed, said method comprising adding phosphoric acid to the polishing slurry.

37. (New) The method of Claim 36 wherein the slurry has a pH value of less than about 6.0.

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39. (New) A chemical mechanical polishing method of planarizing a structure comprising:

- providing a substrate supporting a material layer including at least partially embedded copper (Cu);
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- polishing the material layer and the copper before contracting the polish-stop layer.

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41. (New) The method of Claim 39 wherein said polishing comprises polishing simultaneously the material layer and the copper until contacting the polish-stop layer.

42. (New) The method of Claim 39 wherein said polishing is performed with a polisher until a portion of said material layer and said copper becomes generally aligned with said polish-stop layer.

43. (New) The method of Claim 39 wherein said polishing continues until a portion of the material layer and the copper becomes generally aligned with the polish-stop layer.

44. (New) The method of Claim 39 wherein said polishing comprises polishing a portion of said material layer before polishing a portion of the copper.

45. (New) The method of Claim 39 wherein said forming of at least one polish-stop layer comprises forming said at least one polish-stop layer on an upper surface of said material layer such that a portion of the material layer and the copper extends above the polish stop layer.

46. (New) The method of Claim 39 wherein said forming of at least one polish-stop layer comprises forming a pair of polish-stop layers on an upper surface of said material layer such that a portion of the material layer and the copper extends between and above the pair of polish-stop layers.

47. (New) The method of Claim 46 wherein said copper comprises a copper post.

48. (New) The method of Claim 39 wherein said polishing comprises chemical mechanical polishing.

49. (New) The method of Claim 39 wherein said polish-stop layer comprises tungsten (W).

50. (New) The method of Claim 39 wherein said polish-stop consists essentially of tungsten (W).

51. (New) The method of Claim 39 wherein said polishing comprises polishing the material layer and the copper in a slurry comprising an abrasive and an acid.

52. (New) The method of Claim 51 wherein said acid is phosphoric acid (H_3PO_4).

53. (New) The method of Claim 39 wherein said polishing comprises polishing the material layer and the copper in a slurry consisting of an abrasive and phosphoric acid (H_3PO_4).

54. (New) The method of Claim 39 wherein said polish-stop layer consists of a material which is more resistant to polishing than the material layer and the copper.